Small Business Innovation Research/Small Business Tech Transfer

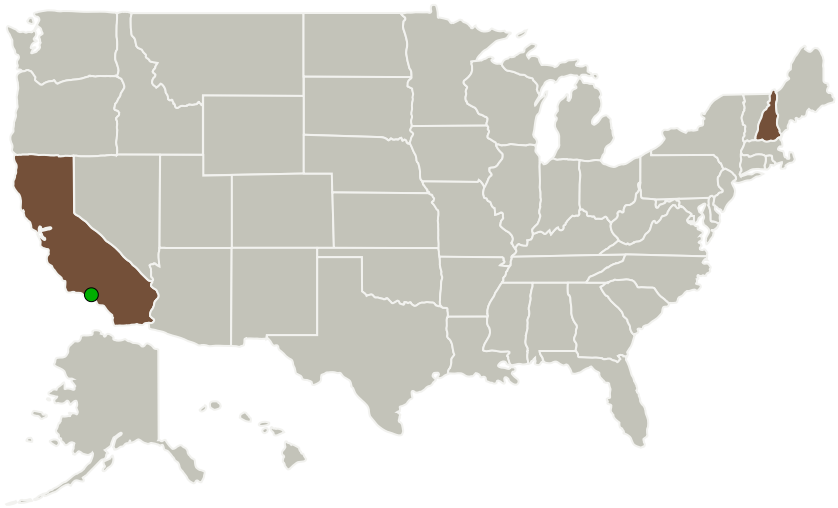
A Two-Phase Pumped Loop Evaporator with Adaptive Flow Distribution for Large Area Cooling, Phase I

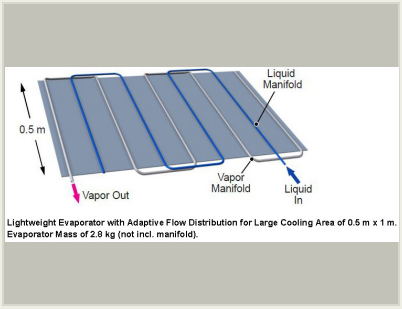
Completed Technology Project (2017 - 2017)

Project Introduction

NASA's future remote sensing science missions require advanced thermal management technologies to maintain multiple instruments at very stable temperatures and utilize waste heat to keep other critical subsystems above minimum operational temperatures. Two-phase pumped loops are an ideal solution for these applications. A critical need for these pumped loops is a microgravity-compatible evaporator having a large cooling area to maintain the temperatures of multiple electronics and instruments. The evaporator must be able to accommodate multiple heat loads with a wide range of heat flux densities and allow heat loads to be mounted on any available locations of its cooling surfaces to facilitate vehicle-level system integration. To this end, Creare proposes to develop a lightweight, compact evaporator with innovative internal design features to adaptively distribute liquid refrigerant to heated areas, preventing dryout in areas with high heat flux. This advanced flow distribution feature reduces liquid recirculation flow in the pumped loop and thus the system power input. The design features also provide strong internal structural support for the evaporator, reducing the size and mass of the evaporator cover plates. In Phase I, we will prove the feasibility of the evaporator by developing a preliminary evaporator design, predicting its overall performance, and demonstrating its key performance features and fabrication processes by testing. In Phase II, we will optimize the evaporator design, fabricate a full-scale evaporator, demonstrate its steady state and transient performance in a representative pumped loop, and deliver it to NASA JPL for further performance evaluation.

Primary U.S. Work Locations and Key Partners





A Two-Phase Pumped Loop Evaporator with Adaptive Flow Distribution for Large Area Cooling, Phase I Briefing Chart Image

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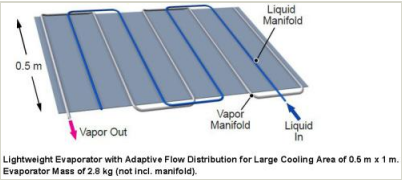
Organizations Performing Work	Role	Type	Location
Creare LLC	Lead Organization	Industry	Hanover, New Hampshire
Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations	
California	New Hampshire

Images



Briefing Chart Image
A Two-Phase Pumped Loop Evaporator with Adaptive Flow Distribution for Large Area Cooling, Phase I Briefing Chart Image *(https://techport.nasa.gov/image/132973)*

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Creare LLC

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

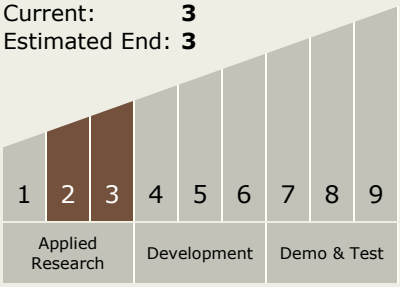
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Weibo Chen

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



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Technology Areas

Primary:

- TX14 Thermal Management Systems
  - TX14.2 Thermal Control Components and Systems
    - TX14.2.2 Heat Transport